

*Lithologic description of cuttings (part A) from drill hole USBM-01,
Ryan Gulch*

Description	Depth interval feet (meters)
Quaternary	
Alluvium, not cemented, moderate-yellowish-brown, very fine grained (0.25 mm); grains mostly quartz; sparse biotite flakes-----	30-45 (9.1-13.7)
Alluvium, possible siltstone, moderate-yellowish-brown, very fine grained, same as above; contains 4 mm fragments of siltstone and sparse fragments of well-cemented sandstone (<2 mm) or quartzite(?)----	45-60 (13.7-18.3)
Tertiary	
Uinta Formation	
Siltstone, pale-yellowish-brown to dark-yellowish-brown, very fine grained, very thinly laminated, well cemented with silica-----	60-75 (18.3-22.9)
Siltstone, predominately dark-yellowish-brown, very fine grained, well-cemented; some laminae are grayish yellow; contains sparse very thinly laminated kerogenous marlstone-----	75-90 (22.9-27.4)
Siltstone, same as above, some dusky-yellowish-brown-----	90-105 (27.4-32.0)
Siltstone, predominately dusky-yellowish-brown, well-cemented (some silica and calcite); laminae are dark yellowish brown and grayish yellow; contains sparse laminae of kerogenous marlstone; breaks with concoidal fracture-----	105-120 (32.0-36.6)
Siltstone, pale-yellowish-brown, massive ~90 percent, and dusky-yellowish-gray kerogenous marlstone; calcite cement-----	120-135 (36.6-41.1)
Siltstone, same as above-----	135-150 (41.1-45.7)
Cement; interval at base of cemented casing-----	150-165 (45.7-50.3)
Siltstone, dark-yellowish-brown; laminated with dark-gray siltstone; scattered (0.25 mm) flakes of biotite that equal 1 percent of rock; some parts have more dark-gray laminae; pyrite present in discrete large masses-----	165-180 (50.3-54.9)

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*Lithologic description of cuttings (part A) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Sandstone, dark-gray, fine- to medium-grained, and minor amounts of light-brown, calcite-cemented siltstone; no calcite in sandstone; 70 percent of the sample is sandstone; dusky-yellowish-brown, fine- to medium-grained sandstone; contains tiny reddish-brown hematite, minor amounts of biotite, and scattered fine grains of rounded frosted quartz-----	180-195 (54.9-59.4)
No sample-----	195-290 (59.4-88.4)
Siltstone, dusky-yellowish-brown, laminated with kerogenous marlstone; contains minor amount of quartzitic sandstone and pyrite fragments-----	290-305 (88.4-93.0)
Sandstone, olive-gray to dusky-yellowish-brown, fine- to medium-grained; contains fragments of siltstone and subrounded quartz, minor biotite flakes, some kerogenous marlstone-----	305-330 (93.0-100.6)
Sandstone, same as above but with more angular quartz fragments-----	330-345 (100.6-105.2)
Sandstone and some siltstone, light-olive-gray; sandstone is fine grained with minor calcite cement and contains 85-90 percent quartz, <5 percent pyrite; both are cemented (silica cement and minor calcite); from cuttings, unit appears to be very thin interbedding of siltstone and sandstone-----	345-360 (105.2-109.7)
Siltstone, dusky-yellowish-brown, well-cemented; contains scattered subrounded quartz and minor (<5 percent) pyrite-----	360-375 (109.7-114.3)
Sandstone, dusky-yellowish-brown, fine- to medium-grained sub-angular quartz; contains pyrite; some siltstone appears to be poorly cemented-----	375-390 (114.3-118.9)
Siltstone, dark-yellowish-brown, very fine to fine-grained, well-cemented; contains minor sandstone (90 percent quartz); minor kerogenous marlstone stringers scattered throughout-----	390-405 (118.9-123.4)

*Lithologic description of cuttings (part A) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Siltstone, dark-yellowish-brown to dusky yellowish-brown, mostly quartz; contains minor sandstone (90 percent quartz), abundant pyrite, and minor kerogenous marlstone; all well cemented with silica and minor calcite-----	405-420 (123.4-128.0)
Siltstone and sandstone, pale-yellowish-brown to dusky-yellowish-brown, very fine to fine-grained, well-cemented; contains minor amounts of kerogenous marlstone; sandstone contains pyrite-----	420-435 (128.0-132.6)
Interbedded sandstone and siltstone, dark-yellowish-brown; 70 percent sandstone, 30 percent siltstone; contains minor amounts of kerogenous marlstone and minor pyrite; unconsolidated-----	435-450 (132.6-137.2)
Interbedded siltstone, marlstone, and sandstone, dark-yellowish-brown to dusky-yellowish-brown; 40 percent siltstone, 40 percent marlstone, 20 percent coarse-grained sandstone; some kerogenous stringers; unconsolidated-----	450-465 (137.2-141.7)
Interbedded marlstone and siltstone, dark-yellowish-brown; 50 percent marlstone, 50 percent unconsolidated siltstone-----	465-495 (141.7-150.9)
Same as above; possibly >60 percent marlstone-----	495-540 (150.9-164.6)
Laminated siltstone and kerogenous marlstone; siltstone (~50 percent of sample) is pale yellowish brown with minor amounts of dark-yellowish-brown calcareous cement; kerogenous marlstone (~50 percent of sample) is dusky yellowish brown; contains minor amounts of frosted quartz-----	540-555 (164.6-169.2)
Same as above, with siltstone increasing to ~90 percent-----	555-570 (169.2-173.7)
Same as above, with siltstone increasing to >95 percent-----	570-585 (173.7-178.3)
Laminated siltstone and kerogenous marlstone; siltstone (80 percent) is mostly pale yellowish brown, some dark yellowish brown, contains calcareous cement; marlstone (20 percent) is medium gray-----	585-600 (178.3-182.9)

*Lithologic description of cuttings (part A) from drill hole USBM-01,
Ryan Gulch--Continued*

Depth interval feet (meters)	Description	Depth interval feet (meters)
Tertiary--Continued		
Uinta Formation--Continued		
5-420 4-128.0)	Laminated siltstone and kerogenous marlstone: siltstone (90 per- cent) is dark yellowish brown, contains calcareous cement; dusky-yellowish-brown marlstone-----	600-615 (182.9-187.5)
0-435 0-132.6)	Laminated kerogenous marlstone and siltstone; marlstone (90 percent) is grayish black to olive black; siltstone (~10 per- cent) is pale yellowish brown and contains calcareous cement-----	615-630 (187.5-192.0)
1-450 1-137.2)	Laminated kerogenous marlstone and fine-grained sandstone with kerogenous streaks; marlstone (95 percent) is grayish black to olive black; sandstone (5 percent) is yellowish gray-----	630-645 (192.0-196.6)
	Laminated kerogenous marlstone and sandstone; marlstone, 90 percent; sandstone, 10 percent-----	645-660 (196.6-201.2)
1-465 1-141.7)	Laminated kerogenous marlstone and sandstone; marlstone (90 Percent) is dusky yellowish brown and pale yellowish brown; sandstone (10 percent) is fine grained-----	660-675 (201.2-205.7)
1-495 1-150.9)	Kerogenous marlstone, dusky-yellowish-brown-----	675-690 (205.7-210.3)
1-540 1-164.6)	Kerogenous marlstone, dusky-yellowish-brown; calcite fills fractures; trace of pale-yellowish-brown, fine-grained sandstone-----	690-700 (210.3-213.4)
Green River Formation		
1-555 1-69.2)	Marlstone, kerogenous, dusky-yellowish-brown; trace of pale- yellowish-brown, fine-grained sandstone with kerogenous streaks-----	700-720 (213.4-219.5)
1-70 1-73.7)	Marlstone, kerogenous as above, with calcite coatings on fracture surfaces-----	720-735 (219.5-224.0)
1-85 1-78.3)	Marlstone, kerogenous as above, 90 percent; 10 percent grayish- orange-pink, fine- to medium-grained sandstone with calcite cement; contains streaks of kerogen and sparse flakes of biotite-----	735-750 (224.0-228.6)
1-90 1-12.9)	Bottom of rock-bit zone	

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch*

Description	Depth interval feet (meters)
Tertiary	
Green River Formation	
Parachute Creek Member	
Oil shale, dusky-yellowish-brown, interlaminated, minor amounts of dark-gray and grayish-brown oil shale; calcite and nahcolite crystals on open fracture surfaces and in healed fractures; core ranges from competent to highly fractured-----	750-820.2 (228.6-250.0)
No sample-----	820.2-821.0 (250.0-250.2)
Oil shale, dusky-brown to dusky-yellowish-brown; calcite and nahcolite crystals on open and healed fracture surfaces; a breccia of clay and oil-shale fragments at 825.7-825.9 feet (251.7-251.7+ m)-----	821.0-830.0 (250.2-253.0)
Oil shale, grayish-black-----	830.0-831.0 (253.0-253.3)
Oil shale, like unit at 821.0-830.0 feet (250.2-253.0 m); below 838 feet (255.4 m) the laminae feather out across core; dusky yellowish brown is dominant color below 844 feet (257.3 m)-----	831.0-853.0 (253.3-260.0)
Marlstone, dusky-, dark-, and pale-yellowish-brown, very thinly laminated; calcite in open and healed fractures; pyrite crystals on fractures in lowest 1 foot (30 cm); occasional vugs, some contain nahcolite-----	853.0-860.0 (260.0-262.1)
Siltstone, interlaminated and bedded with marlstone. A Groove-----	860.0-868.0 (262.1-264.6)
Oil shale, pale-yellowish-brown and dark- and dusky-yellowish-brown, very thinly laminated; contains pyrite crystals throughout unit-----	868.0-869.0 (264.6-264.9)
No sample-----	869.0-870.0 (264.9-265.2)
Oil shale, like unit at 853.0-860.0 feet (260.0-262.1 m); brecciated layer of oil shale in a silty matrix, with pyrite crystals at 875.0-875.6 feet (266.7-266.9 m)-----	870.0-886.3 (265.2-270.1)

Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Siltstone, dark-yellowish-brown; contains streaks of kerogen-----	886.3-886.5 (270.1-270.2)
Oil shale, like unit at 853.0-860.0 feet (260.0-262.1 m)-----	886.5-889.3 (270.2-271.1)
Oil shale, dusky-yellowish-brown, laminated-----	889.3-891.4 (271.1-271.7)
Oil shale, like unit at 853.0-860.0 feet (260.0-262.1 m); pyrite crystals in lower 1 foot (30 cm)-----	891.4-893.0 (271.7-272.2)
No sample-----	893.0-895.0 (272.2-272.8)
Oil shale, dusky-yellowish-brown, laminated with dark-yellowish- brown oil shale; pyrite and calcite crystals disseminated throughout core; some discing of core-----	895.0-904.0 (272.8-275.5)
Siltstone, dusky-yellowish-brown-----	904.0-904.6 (275.5-275.7)
Oil shale, like unit at 895.0-904.0 feet (272.8-275.5 m)-----	904.6-913.5 (275.7-278.4)
No sample-----	913.5-915.0 (278.4-278.9)
Oil shale, dusky-yellowish-brown, thinly laminated with pale- yellowish-brown oil shale; calcite on healed fractures-----	915.0-928.2 (278.9-282.9)
Siltstone, pale-yellowish-brown; contains thin wavy beds of kerogenous material-----	928.2-928.4 (282.9-283.0)
Oil shale, like unit at 915.0-928.2 feet (278.9-282.9 m); core shattered and disced; vuggy-----	928.4-929.0 (283.0-283.2)
Oil shale, dark-yellowish-brown, laminated with dusky-yellowish- brown oil shale; pale yellowish brown in lowest 1 foot (30 cm); some laminae are wavy, most are flat and horizontal; pyrite and calcite crystals on open and healed fractures; minor feathering of some laminae-----	929.0-949.0 (283.2-289.3)
Gilsonite(?), laminated with oil shale and a white micro- crystalline mineral (noncalcareous)-----	949.0-949.8 (289.3-289.5)

Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, like unit at 929.0-949.0 feet (283.2-289.3 m)-----	949.8-951.7 (289.5-290.1)
Brecciated zone; oil shale with silt- and sand-size matrix-----	951.7-951.9 (290.1-290.1+)
Oil shale, like unit at 929.0-949.0 feet (283.2-289.3 m)-----	951.9-980.0 (290.1+-298.7)
Oil shale, dark-yellowish-brown; laminated with dusky-yellowish- brown oil shale; brecciated zones at 982 and 986 feet (299.3 and 300.5 m) each 0.5 foot (15 cm) thick; open and partially open vugs first appear at 989.7 feet (301.7 m) with others at 994.0 and 996.0 feet (303.0 and 303.6 m); dusky-yellowish-brown color predominates at 987.0 feet (300.8 m); pyrite and calcite on fracture surfaces-----	980.0-997.0 (298.7-303.9)
Sandy-silty layer interbedded with thinly laminated oil shale-----	997.0-997.8 (303.9-304.1)
Oil shale, like unit at 980.0-997.0 feet (298.7-303.9 m); discing of core between 1,000.0 and 1,006.0 feet (204.8 and 306.6 m); brecciated zones at 1,001.0-1,001.3 feet (305.1-305.2 m) and 1,011.0-1,014.0 feet (308.2-309.1 m); dusky-yellowish-brown color predominates below 1,007.5 feet (307.1 m)-----	997.8-1,013.0 (304.1-308.8)
Sandstone, medium-grained-----	1,013.0-1,013.2± (308.8-308.8±)
Oil shale, like unit at 980.0-997.0 feet (298.7-303.9 m)-----	1,013.2±-1,015.0 (308.8±-309.4)
Oil shale, grayish-black to black-----	1,015.0-1,015.5 (309.4-309.5)
Oil shale, dark-yellowish-brown; interlaminated with dusky- yellowish-brown oil shale; lenses, pods, and thin beds of siltstone mainly between 1,016.0 and 1,019.1 feet (309.7- 310.6 m) and 1,022.0 and 1,023.0 feet (311.5-311.8 m); fairly competent core-----	1,015.5-1,023.0 (309.5-311.8)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Interval feet (meters)	Description	Depth interval feet (meters)
Tertiary--Continued		
Green River Formation--Continued		
Parachute Creek Member--Continued		
	Oil shale, dark-yellowish-brown; interlaminated with minor amounts of very dusky red oil shale; contains several brecciated zones of oil-shale fragments in a sandy-silty matrix-----	1,023.0-1,039.0 (311.8-316.7)
	No sample-----	1,039.0-1,039.2 (316.7-316.7+)
	Oil shale and clay(?); upper 5 feet (1.5 m) is dark-yellowish-brown oil shale containing vugs partially filled with nahcolite; lowest 4 feet (1.2 m) is pale-yellowish-brown clay containing a few 2-inch (5-cm) fragments of oil shale-----	1,039.2-1,048.2 (316.7+-319.5)
	No sample-----	1,048.2-1,052.6 (319.5-320.8)
	Oil shale, light- to dusky-yellowish-brown; interlaminated with light-yellowish-brown siltstone-----	1,052.6-1,063.0 (320.8-324.0)
	Oil shale, pale- to dusky-yellowish-brown, with minor beds of pale-yellowish-brown tuff(?); leaching evident at 1,072 and 1,083 feet (326.7 and 330.1 m); nahcolite in vugs at 1,083 feet (330.1 m); core discs easily-----	1,063.0-1,083.5 (324.0-330.3)
	No sample-----	1,083.5-1,087.0 (330.3-331.3)
	Like unit at 1,063.0-1,083.5 feet (324.0-330.3 m); tuff(?) layers occur between 1,088.6 and 1,089.6 feet (331.8 and 332.1 m)-----	1,087.0-1,093.0 (331.3-333.1)
	Oil shale, pale- to dusky-yellowish-brown, thinly to very thinly laminated; calcite on fracture surfaces; sparse vugs as much as 2. inches (5 cm) in diameter contain minor amounts of nahcolite-----	1,093.0-1,109.0 (333.1-338.0)
	Oil shale, as above, interbedded with pale- to moderate-yellowish-brown siltstone beds at 1,109-1,110, 1,112, 1,117, 1,120-1,121, and 1,125 feet (338.0-338.3, 338.9, 340.5, 341.4-341.7, and 342.9 m)-----	1,109.0-1,125.0 (338.0-342.9)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, like unit at 1,093.0-1,109.0 feet (333.1-338.0 m), with a very thin tuff(?) bed at 1,149 feet (350.2 m); collapse breccia zone at 1,142.0-1,142.6 feet (348.1-348.3 m) may match zone at 1,174-1,176.5 feet (357.8-358.6 m) in drill hole USBM-02A; core-loss interval below may match collapse breccia zone at 1,187 feet (361.8 m) in USBM-02A-----	1,125.0-1,152.2 (342.9-351.2)
No sample-----	1,152.2-1,155.2 (351.2-352.1)
Oil shale, pale-yellowish-brown, interlaminated with minor very thin laminae of dark- and dusky-yellowish-brown to olive-black oil shale; contains a few scattered vugs as wide as 0.75 inch (2 cm), some containing minor amounts of nahcolite-----	1,155.2-1,167.0 (352.1-355.7)
Oil shale, as above, interlaminated with thin-bedded, moderate-yellowish-brown siltstone; possible thin tuff bed at 1,167 feet (355.7 m)-----	1,167.0-1,172.5 (355.7-357.4)
Oil shale, like unit at 1,155.2-1,167.0 feet (352.1-355.7 m); collapse breccias at 1,172.5-1,174.5 feet (355.7-358.0 m) and 1,175.4-1,178.0 feet (358.3-359.1 m); a thin, medium-light-gray pyritiferous siltstone at 1,174.5 feet (358.0 m); zone at 1,172.5-1,174.5 feet (357.4-358.0 m) contains a layer of white crystalline mineral; unit may correspond to core-loss interval at 1,201.8-1,209.5 feet (366.3-368.7 m) in drill hole USBM-02A-----	1,172.5-1,178.0 (357.4-359.1)
Oil shale, dark-yellowish-brown, very thinly laminated; thin, moderate-yellowish-brown siltstone layer at 1,181 feet (360.0 m), moderately well cemented; dusky-yellowish-brown to dusky-brown oil shale at 1,185-1,189 feet (361.2-362.4 m); open vugs, as much as 2 inches (5 cm) contain minor amounts of nahcolite; evidence of leaching at 1,197.4-1,198.0 feet (365.0-365.2 m); minor amounts of calcite and pyrite on fracture surfaces; unit is brittle and incompetent-----	1,178.0-1,203.9 (359.1-366.9)

Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued

Depth interval feet (meters)	Description	Depth interval feet (meters)
	Tertiary--Continued	
	Green River Formation--Continued	
	Parachute Creek Member--Continued	
	No sample-----	1,203.9-1,207.2 (366.9-368.0)
1,152.2-1,155.2 (351.2-352.1)	Siltstone, pale-yellowish-brown and yellowish-gray, very thinly laminated; some is thin bedded; contains minor amounts of dark- to dusky-yellowish-brown, very finely laminated oil shale and marlstone(?); faults at 1,218 and 1,230 feet (371.2 and 374.9 m)--the lower one has abundant calcite dispersed throughout zone-----	1,207.2-1,230.0 (368.0-374.9)
1,167.0-1,172.5 (355.7-357.4)	Marlstone, pale-yellowish-brown, yellowish-gray, and dark-yellowish-brown, very thinly laminated to thin-bedded; contains minor amounts of dusky-yellowish-brown oil-shale laminae and thin siltstone stringers; vugs, 1/4 inch (1 cm) in diameter, filled with calcite and minor amounts of nahcolite; calcite and pyrite on fracture surfaces; base of R-6 zone at 1,240 feet (378.0 m)-----	1,230.0-1,287.7 (374.9-392.5)
	No sample-----	1,287.7-1,292.7 (392.5-394.0)
	Siltstone, pale-yellowish-brown, yellowish-gray, and medium-gray, thinly bedded; contains minor amounts of marlstone and oil shale; vugs (as wide as 3 in.) contain calcite and nahcolite; pyrite and calcite on fracture surfaces; collapse breccia or fault zone at 1,318-1,320.8 feet (401.7-402.6 m)-----	1,292.7-1,320.8 (394.0-402.6)
1,178.0-1,179.1 (359.1-359.9)	No sample; base of L-5 zone at 1,327 feet (403.6 m)-----	1,320.8-1,330.3 (402.6-405.5)
	Oil shale, dusky-yellowish-brown and dusky-brown, very thinly laminated; contains minor amounts of siltstone and marlstone; evidence of leaching at 1,330.3-1,331.3 feet (405.5-405.8 m); small blebs of nahcolite at 1,330.3-1,332.7 feet (405.5-406.2 m)-----	1,330.3-1,335.1 (405.5-406.9)
1,203.9-1,207.2 (366.9-369.9)	No sample-----	1,335.1-1,335.9 (406.9-407.2)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, pale-yellowish-brown and yellowish-gray, very thinly laminated, platy; interlaminated with nahcolite and halite-----	1,335.9-1,353.4 (407.2-412.5)
No sample-----	1,353.4-1,363.8 (412.5-415.7)
Oil shale, nahcolite, and halite, like unit at 1,335.9- 1,353.4 feet (407.2-412.5 m)-----	1,363.8-1,370.5 (415.7-417.7)
Oil shale, brownish-black and dusky-yellowish-brown, very thinly laminated; contains rosettes of nahcolite-----	1,370.5-1,371.4 (417.7-418.0)
Oil shale, pale-yellowish-brown and yellowish-gray, very thinly laminated; interlaminated with pale-brown nahcolite and minor amounts of halite; crystalline zone at 1,373.1- 1,379.1 feet (418.5-420.3 m); pitting along laminae in this crystalline zone; calcite on some fracture surfaces-----	1,371.4-1,385.5 (418.0-422.3)
Oil shale, dusky-yellow-brown and brownish-black, very thinly laminated; light-brown transparent nahcolite rosettes scattered throughout rock-----	1,385.5-1,393.8 (422.3-424.8)
Oil shale, moderate-brown, dark-yellowish-brown, and dusky- brown, very thinly laminated; minor laminae of marlstone; contains light-brown nahcolite rosettes as much as 6 inches (15.2 cm) in diameter and minor halite beds-----	1,393.8-1,421.2 (424.8-433.2)
Oil shale, moderate-brown, moderate-yellowish-brown and dark- yellowish-brown, very thinly laminated; intervals between 1,430.0-1,448.0, 1,451.0-1,477.0, 1,484.0-1,486.0, and 1,487.5-1,489.0 feet (435.9-441.4, 442.3-450.2, 452.8- 452.9, and 453.3-453.8 m) contain nahcolite rosettes as much as 6 inches (15.2 cm) in diameter-----	1,421.2-1,489.0 (433.2-453.8)
Halite, white, translucent-----	1,489.0-1,492.0 (453.8-454.8)

Lithologic description of core (part B) from drill hole USBM-01,
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Depth interval feet (meters)	Description	Depth interval feet (meters)
	Tertiary--Continued	
	Green River Formation--Continued	
	Parachute Creek Member--Continued	
15.9-1,353.4 17.2-412.5)	Oil shale, dark- and dusky-yellowish-brown, very thinly laminated; with minor amounts of yellowish-gray and dusky-brown oil shale; moderate-brown translucent crystalline nahcolite in beds, rosettes, and pods scattered through unit-----	1,492.0-1,510.8 (454.8-460.5)
13.4-1,363.8 2.5-415.7)	Nahcolite, moderate-brown, translucent, and pale-yellowish-brown, opaque-----	1,510.8-1,515.0 (460.5-461.8)
13.8-1,370.5 5.7-417.7)	Oil shale, like unit at 1,492.0-1,510.8 feet (454.8-460.5 m); contains small amounts of olive-black oil shale-----	1,515.0-1,524.0 (461.8-464.5)
10.5-1,371.4 7.7-418.0)	Nahcolite, like unit at 1,510.8-1,515.0 feet (460.5-461.8 m)-----	1,524.0-1,534.0 (464.5-467.6)
14-1,385.5 1.0-422.3)	Oil shale, dusky- to dark-yellowish-brown, very thinly laminated; contains pods and irregular lenses of moderate-brown, translucent, crystalline nahcolite-----	1,534.0-1,549.0 (467.6-472.1)
15-1,393.8 3-424.8)	Nahcolite, pale-yellowish-brown, opaque, crystalline-----	1,549.0-1,554.0 (472.1-473.7)
18-1,421.2 8-433.2)	Oil shale, dusky-yellowish-brown, dusky-brown, brownish-black, and minor dark-yellowish-brown, very thinly laminated; contains a 0.8-foot-thick (24-cm) nahcolite bed at 1,575.0 feet (480.1 m)-----	1,554.0-1,587.0 (473.7-483.7)
	Nahcolite, white to pale-yellowish-brown, bedded, opaque, crystalline; interbedded with laminae of oil shale-----	1,587.0-1,598.3 (483.7-487.2)
	Oil shale, like unit at 1,554-1,587 feet (473.7-483.7 m)-----	1,598.3-1,599.3 (487.2-487.5)
2-1,489.0 2-453.8)	No sample-----	1,599.3-1,600.8 (487.5-487.9)
0-1,492.0 8-454.8)	Oil shale, like unit at 1,554-1,587 feet (473.7-483.7 m)-----	1,600.8-1,603.8 (487.9-488.8)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Halite, bedded-----	1,603.8-1,604.3 (488.8-489.0)
Nahcolite and oil shale, interbedded-----	1,604.3-1,610.0 (489.0-490.1)
Oil shale, like unit at 1,554-1,587 feet (473.7-483.7 m)-----	1,610.0-1,616.0 (490.1-492.6)
Nahcolite and oil shale, interbedded-----	1,616.0-1,620.5 (492.6-493.9)
Oil shale, like unit at 1,554-1,587 feet (473.7-483.7 m)-----	1,620.5-1,622.6 (493.9-494.6)
Nahcolite and oil shale, interbedded-----	1,622.6-1,629.0 (494.6-496.5)
Halite, bedded-----	1,629.0-1,629.5 (496.5-496.7)
Nahcolite and oil shale, interbedded-----	1,629.5-1,632.0 (496.7-497.4)
No sample (loss due to solubility of salts)-----	1,632.0-1,639.0 (497.4-499.6)
Oil shale, dusky-yellowish-brown, dark-yellowish-brown and minor light-brown, very thinly laminated; interbedded with halite zones, as much as 0.5 foot (15 cm) thick, and moderate-brown, crystalline, translucent nahcolite beds and rosettes; some nahcolite is pale yellowish brown-----	1,639.0-1,660.0 (499.6-506.0)
Oil shale, as above-----	1,660.0-1,667.7 (506.0-508.3)
No sample-----	1,667.7-1,669.0 (508.3-508.7)
Oil shale, like unit at 1,639.0-1,660.0 feet (499.6-506.0 m); contains scattered nahcolite rosettes; base of R-5 zone at 1,680.9 feet (512.3 m)-----	1,669.0-1,680.9 (508.7-512.3)
Nahcolite, dusky- to dark-yellowish-brown; contains a halite stringer at 1,682 feet (512.7 m)-----	1,680.9-1,686.9 (512.3-514.2)
No sample-----	1,686.9-1,699.0 (514.2-517.9)
Nahcolite, like unit at 1,680.9-1,686.9 feet (512.3-514.2 m)-----	1,699.0-1,702.5 (517.9-518.9)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Depth interval feet (meters)	Description	Depth interval feet (meters)
Tertiary--Continued		
Green River Formation--Continued		
Parachute Creek Member--Continued		
8-1,604.3 8-489.0)	Oil shale, dusky-yellowish-brown, with minor amounts of pale-yellowish-brown, very thinly laminated oil shale; moderate-brown, translucent crystalline nahcolite rosettes as much as 3 inches (8 cm) in diameter scattered throughout core-----	1,702.5-1,715.0 (518.9-522.7)
3-1,610.0 0-490.1)	Nahcolite, pale-yellowish-brown, opaque, crystalline, thin-bedded-----	1,715.0-1,717.0 (522.7-523.3)
0-1,616.0 1-492.6)	Oil shale, like unit at 1,702.5-1,715.0 feet (518.9-522.7 m); contains some brownish-black oil shale-----	1,717.0-1,727.9 (523.3-526.7)
0-1,620.5 1-493.9)	No sample-----	1,727.9-1,729.0 (526.7-527.0)
1-1,622.6 1-494.6)	Oil shale, like unit at 1,717.0-1,727.9 feet (523.3-526.7)-----	1,729.0-1,734.5 (527.0-528.7)
1-1,629.0 1-496.5)	Nahcolite, moderate-brown, translucent, crystalline, thin-bedded; with minor amounts of oil shale-----	1,734.5-1,737.0 (528.7-529.4)
1-1,629.5 1-496.7)	Oil shale, like unit at 1,717.0-1,727.9 feet (523.3-526.7 m)-----	1,737.0-1,739.0 (529.4-530.0)
1,632.0 1-497.4)	Nahcolite, like unit at 1,734.5-1,737.0 feet (528.7-529.4 m); base of L-4 zone at 1,742 feet (531.0 m)-----	1,739.0-1,742.0 (530.0-531.0)
1,639.0 1-499.6)	Oil shale, like unit at 1,717.0-1,727.9 feet (523.3-526.7 m); contains a 4-inch-thick (10-cm) bed of nahcolite and halite at 1,750.9 feet (533.7 m)-----	1,742.0-1,759.0 (531.0-536.1)
660.0 1-506.0)	Nahcolite, pale-yellowish-brown and moderate-brown, opaque to translucent, thin-bedded; with minor oil shale-----	1,759.0-1,768.5 (536.1-539.0)
667.7 1-508.3)	Oil shale, dark-yellowish-brown and dusky-yellowish-brown, very thinly laminated-----	1,768.5-1,777.5 (539.0-541.8)
669.0 1-509.7)	Nahcolite, like unit at 1,759.0-1,768.5 feet (536.1-539.0 m)-----	1,777.5-1,779.5 (541.8-542.4)
80.9 1-513.3)	Oil shale, like unit at 1,768.5-1,777.5 feet (539.0-541.8 m)-----	1,779.5-1,783.0 (542.4-543.5)
6.9 1-512.2)		
9.0 1-519.9)		
2.5 1-519.9)		

Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Nahcolite, like unit at 1,759.0-1,768.5 feet (536.1-539.0 m)-----	1,783.0-1,788.2 (543.5-545.0)
No sample-----	1,788.2-1,789.0 (545.0-545.3)
Oil shale, like unit at 1,768.5-1,777.5 feet (539.0-541.8 m); nahcolite rosettes, as wide as 4 inches (10 cm), and nahco- lite beds scattered throughout interval-----	1,789.0-1,818.9 (545.3-554.4)
No sample-----	1,818.9-1,819.4 (554.4-554.6)
Oil shale, dusky-yellowish-brown, contains rosettes of nahco- lite as much as 9 inches (23 cm) in diameter-----	1,819.4-1,828.4 (554.6-557.3)
Nahcolite, bedded and rosettes-----	1,828.4-1,830.0 (557.3-557.8)
Oil shale, nahcolite, and minor marlstone, interbedded and laminated, pale-yellowish-brown to dusky-yellowish-brown; rosettes as much as 10 inches (25 cm) in diameter; halite fills vertical fractures at 1,834 and 1,846 feet (559.0 and 562.7 m)-----	1,830.0-1,850.0 (557.8-563.9)
Oil shale, dusky-yellowish-brown, laminated with dusky- to dark- yellowish-brown marlstone; nahcolite rosettes as much as 6 inches (15 cm) in diameter every foot or two; fine- to medium-grained nahcolite bed at 1,873-1,873.5 feet (570.9- 571.0 m), and a 0.1-foot-thick (3-cm) bed at 1,853.8 feet (565.0 m)-----	1,850.0-1,874.0 (563.9-571.2)
No sample-----	1,874.0-1,879.0 (571.2-572.7)
Nahcolite, interbedded with dark-yellowish-brown and minor dusky-yellowish-brown marlstone(?); nahcolite beds range from 0.3 to 1.0 foot (8 to 30 cm) thick; dark-gray silt- stone layer at 1,887.5-1,887.7 feet (575.3-575.4 m); nah- colite rosettes scattered throughout lower half of unit (1,893-1,907.4 feet (577.0-581.4 m))-----	1,879.0-1,907.4 (572.7-581.4)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dark-yellowish-brown, thinly laminated; minor laminae are dusky yellowish brown; bedded opaque nahcolite at 1,908.2-1,908.4 and 1,921.3-1,921.5 feet (581.6-581.7 and 585.6-585.7 m); nahcolite rosettes as much as 7 inches (18 cm) in diameter, most are 3-5 inches (8-15 cm); eroded rosettes cause core to break in 0.5- to 2-foot (15- to 60-cm) lengths-----	1,907.4-1,937.2 (581.4-590.5)
No sample-----	1,937.2-1,937.4 (590.5-590.5+)
Oil shale, dark- to dusky-yellowish-brown, thinly laminated; thin interbeds of nahcolite at 1,943, 1,960, 1,961.5, 1,969.8-1,970.2, and 1,972.3-1,972.9 feet (592.2, 597.4, 597.8, 600.4-600.5, and 601.2-601.3 m); nahcolite rosettes between 1,946 and 1,967 feet (593.1 and 599.5 m) and scattered between 1,968 and 1,997 feet (599.8 and 608.7 m); abundant dolomite lenses as long as 1 inch (3 cm) and as high as 1/8 inch (0.3 cm) throughout oil shale; "60 bed" at 1,988-1,992 feet (605.9-607.2 m); base of R-4 zone at 1,997 feet (608.7 m)-----	1,937.4-1,997.0 (590.5+-608.7)
Marlstone(?), dark-yellowish-brown, laminated with minor amounts of dusky-yellowish-brown oil shale; unit contains thin-bedded nahcolite at 2,002.0, 2,004.6, 2,017.6, and 2,020.6 feet (610.2, 611.0, 615.0, and 615.9 m); nahcolite rosettes 1-3 inches (3-8 cm) in diameter below 2,015 feet (614.2 m); bottom of L-3 zone at 2,026 feet (617.5 m)-----	1,997.0-2,025.9 (608.7-617.5)
No sample-----	2,025.9-2,027.1 (617.5-617.9)
Oil shale, dark-yellowish-brown, interlaminated and interbedded with bedded nahcolite, ranging from laminae to 3 inches (8 cm) thick; unit contains pale-yellowish-brown lenses of dolomite as much as 2 inches (5 cm) long (most are 1/4-1 in. (1-3 cm)); rock is 50 percent or more nahcolite; rosettes of nahcolite as much as 1.5 feet (45 cm) in diameter-----	2,027.1-2,085.7 (617.9-635.7)

Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
No sample-----	2,085.7-2,087.0 (635.7-636.1)
Oil shale, like unit at 2,027.1-2,085.7 feet (617.9-635.7 m), with <u>nahcolite</u> beds as much as 6 inches (15 cm) thick-----	2,087.0-2,094.0 (636.1-638.3)
Oil shale, dark- to dusky-yellowish-brown, containing <u>nahcolite</u> rosettes-----	2,094.0-2,116.3 (638.3-645.0)
No sample-----	2,116.3-2,117.0 (645.3-647.1)
Nahcolite, dark-yellowish-brown, bedded-----	2,117.0-2,123.0 (645.3-647.1)
Oil shale, dusky- to dark-yellowish-brown; unit contains opaque and translucent brown <u>nahcolite</u> rosettes as much as 1 foot (30 cm) in diameter (most are 3-5 in. (8-15 cm)); pale- yellow-brown lenses of dolomite below 2,137 feet (651.4 m)-----	2,123.0-2,146.5 (647.1-654.3)
No sample-----	2,146.5-2,147.5 (654.3-654.6)
Oil shale, dusky-yellowish-brown, interlaminated with minor dark-yellowish-brown marlstone; upper 3 feet (90 cm) is interbedded marlstone, <u>nahcolite</u> , and <u>nahcolite</u> rosettes; base of R-3 zone-----	2,147.5-2,163.0 (654.6-659.3)
Marlstone(?) dark-yellowish-brown, thinly laminated-----	2,163.0-2,175.5 (659.3-663.1)
No sample-----	2,175.5-2,177.5 (663.1-663.7)
Marlstone(?), like unit at 2,163-2,175.5 feet (659.3- 663.1 m)-----	2,177.5-2,180.5 (663.7-664.6)
Oil shale, dusky- and dark-yellowish-brown, thinly laminated-----	2,180.5-2,189.0 (664.6-667.2)
<u>Nahcolite</u> , bedded-----	2,189.0-2,195.0 (667.2-669.0)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Interval feet (meters)	Description	Depth interval feet (meters)
Tertiary--Continued		
Green River Formation--Continued		
Parachute Creek Member--Continued		
-2,087.0 -636.1)	Oil shale, dark- to dusky-yellowish-brown, laminated; contains minor amounts of marlstone(?) and bedded nahcolite; nahcolite rosettes as large as 8 inches (20 cm) (most are 2-4 in. (5-8 cm) scattered throughout core; dolomite lenses in upper 32 feet (9.8 cm)-----	2,195.0-2,245.0 (669.0-684.3)
-2,094.0 -638.3)	Marlstone(?), dark-yellowish-brown, laminated; contains minor amounts of nahcolite-----	2,245.0-2,254.3 (684.3-687.1)
-2,116.3 -645.0)	No sample-----	2,254.3-2,258.0 (687.1-688.2)
-2,117.0 -647.1)	Oil shale, dusky- to dark-yellowish-brown, laminated-----	2,258.0-2,268.0 (688.2-691.3)
-2,123.0 -647.1)	Oil shale(?), dark-yellowish-brown, laminated; contains dolomite lenses 1/8-1/2 inch (0.3-1 cm) long-----	2,268.0-2,281.0 (691.3-695.2)
-2,146.5 -654.3)	Garden Gulch Member	
-2,147.5 -654.6)	No sample. Blue marker at 2,284 feet (696.2 m); base of R-2 zone-----	2,281.0-2,286.0 (695.2-696.8)
-2,163.0 -659.3)	Oil shale, dusky- to dark-yellowish-brown, laminated; dolomite lenses-----	2,286.9-2,290.5 (696.8-698.1)
-2,175.5 -663.1)	Oil shale, dusky-yellow-brown, laminated; unit has what appear to be slickensides on horizontal fracture surfaces-----	2,290.5-2,299.0 (698.1-700.7)
-2,177.5 -663.7)	Interbedded shale, marlstone, and a white bedded material; shale is bluish gray from 2,305 to 2,310 feet (702.6-704.1 m); marlstone is dusky yellowish brown, laminated to thin bedded; white material between 2,299 and 2,305 feet (700.7 and 702.6 m) is in layers less than 0.1 foot (3 cm) thick; core discs easily; base of L-1 zone-----	
-2,180.5 -664.6)		2,299.0-2,310.0 (700.7-704.1)
-2,189.0 -667.2)		
-2,195.0 -669.0)		

Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Garden Gulch Member--Continued	
Marlstone, oil shale, and shale, interlaminated and interbedded, dark- to dusky-yellowish-brown; whitish-gray, very thin beds between 2,344.5-2,346.0 feet (714.6-715.1 m); fossils in 2,326-2,327-foot (709.0-709.3-m) interval may be fish vertebrae; core discs easily, shattered in many places-----	2,310.0-2,382.0 (704.1-726.0)
No sample, drilled with rock bit-----	2,382.0-2,382.5 (726.0-726.2)
Total depth-----	2,382.5 (726.2)

T 15, R 97W, S 31

Table 1 -- Lithologic description of core from drill hole USBM-01

Description	Interval thickness ft (m)
Core:	
Oil shale, dusky-yellowish-brown, laminated with minor amounts of dark-gray and grayish-brown oil shale. Calcite and nahcolite crystals on open fracture surfaces and in healed fractures. Core ranges from competent to highly fractured-----	750-820.2 (228.6-250.0)
No recovery-----	820.2-821.0 (250.0-250.2)
Oil shale, dusky-brown to dusky-yellowish-brown. Calcite and nahcolite crystals on open and healed fracture surfaces. At 825.7-825.9 ft (251.7-251.7+ m) is a breccia of clay and oil shale fragments-----	821.0-830.0 (250.2-253.0)
Oil shale, grayish-black-----	830.0-831.0 (253.0-253.3)
Oil shale, like unit at 821.0-830.0 ft (250.2-253.0 m). Below 838 ft the laminae feather out across core. Dusky-yellowish-brown is dominant color below 844 ft (257.3 m)-----	831.0-853.0 (253.3-260.0)
Marlstone, dusky-, dark-, and pale-yellowish-brown, very thinly laminated. Calcite in open and healed fractures, pyrite crystals on fractures in lower 1 ft (30 cm). Occasional vugs with some containing nahcolite-----	853.0-860.0 (260.0-262.1)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Siltstone, interlaminated and bedded with marlstone.	
A Groove-----	860.0-868.0 (262.1-264.6)
Oil shale, pale-yellowish-brown with dark- and dusky-yellowish-brown, very thinly laminated pyrite crystals throughout unit-----	868.0-869.0 (264.6-269.4)
No recovery-----	869.0-870.0 (264.4-265.2)
Oil shale, like unit at 853.0-860.0 ft (260.0-262.1 m). Brecciated layer of oil shale in a silty matrix with pyrite crystals 875.0-875.6 ft	
(266.7-266.9 m)-----	870.0-886.3 (265.2-270.1)
Siltstone, dark-yellowish-brown, containing kerogenous streaks-----	886.3-886.5 (270.1-270.2)
Oil shale, like unit at 853.0-860.0 ft (260.0-262.1 m)-----	886.5-889.3 (270.2-271.1)
Oil shale, dusky-yellowish-brown, laminated-----	889.3-891.4 (271.1-271.7)
Oil shale, like unit at 853.0-860.0 ft (260.0-262.1 m). Pyrite crystals in lower 1 ft (30 cm)-----	891.4-893.0 (271.7-272.2)
No recovery. (May be mahogany marker)-----	893.0-895.0 (272.2-272.8)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, dusky-yellowish-brown laminated with dark yellowish brown. Pyrite and calcite crystals disseminated throughout core. Some discing of core. [May be mahogany bed]	895.0-904.0 (272.8-275.5)
Siltstone, dusky-yellowish-brown	904.0-904.6 (275.5-275.7) MM
Oil shale, like unit at 895.0-904.0 ft (272.8-275.5 m)	904.6-913.5 (275.7-278.4)
No recovery	913.5-915.0 (278.4-278.9)
Oil shale, dusky-yellowish-brown, thinly laminated with pale yellowish brown. Calcite on healed fractures--	915.0-928.2 (278.9-282.9)
Siltstone, pale-yellowish-brown, contains thin wavy beds of kerogenous material	928.2-928.4 (282.9-283.0)
Oil shale, like unit at 915.0-928.2 ft (278.9-282.9 m), core shattered and disced, vuggy	928.4-929.0 (283.0-283.2)
Oil shale, dark-yellowish-brown, laminated with dusky yellowish brown, pale yellowish brown in lower 1 ft (30 cm). Some laminae are wavy, most are flat and horizontal. Pyrite and calcite crystals on open and healed fractures. Minor feathering of some	929.0-949.0 (283.2-289.3)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Gilsonite(?), laminated with oil shale and a white microcrystalline mineral (noncalcareous)-----	949.0-949.8 (289.3-289.5)
Oil shale, like unit at 929.0-949.0 ft (283.2-289.3 m)-----	949.8-951.7 (289.5-290.1)
Brecciated zone, oil shale with silt- and sand-size matrix-----	951.7-951.9 (290.1-290.1+)
Oil shale, like unit at 929.0-949.0 ft (283.2-289.3 m)-----	951.9-980.0 (290.1+-298.7)
Oil shale, dark-yellowish-brown laminated with dusky yellowish brown. Brecciated zones at 982 and 986 ft (299.3 and 300.5 m) each .5 ft (15 cm) thick. Open and partially open vugs first appear at 989.7 ft (301.7 m) with others at 994.0 and 996.0 ft (303.0 and 303.6 m). Dusky-yellowish- brown color predominates 987.0 ft (300.8 m).	980.0-997.0 (298.7-303.9)
Sandy-silty layer interbedded with thinly laminated oil shale-----	997.0-997.8 (303.9-304.1)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, like unit at 980.0-997.0 ft (298.7-303.9 m).	
Discing of core between 1,000.0 and 1,006.0 ft	
(204.8 and 306.6 m). Brecciated zones at	
1,001.0-1,001.3 ft (305.1-305.2 m) and	
1,011.0-1,014.0 ft (308.2-309.1 m). Dusky-	
yellowish-brown color predominates below 1,007.5 ft	
(307.1 m)-----	997.8-1,013.0 (304.1-308.8)
Sandstone, medium grained-----	1,013.0-1,013.2 [±] (308.8-308.8+)
Oil shale, like unit at 980.0-997.0 ft (298.7-303.9 m)--	1,013.2 [±] -1,015.0 (308.8+-309.4)
Oil shale, grayish-black to black-----	1,015.0-1,015.5 (309.4-309.5)
Oil shale, dark-yellowish-brown interlaminated with dusky yellowish brown, lenses, pods, and thin beds of siltstone mainly between 1,016.0-1,019.1 ft (309.7-310.6 m) and 1,022.0-1,023.0 ft (311.5-311.8 m). Fairly competent core-----	1,015.5-1,023.0 (309.5-311.8)
Oil shale, dark-yellowish-brown interlaminated with minor amounts of very dusky red. Contains several brecciated zones of oil shale fragments in a sandy-silty matrix-----	1,023.0-1,039.0 (311.8-316.7)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
No recovery-----	1,039.0-1,039.2 (316.7-316.7+)
Oil shale and clay(?). Upper 5 ft (1.5 m) is dark- yellowish-brown oil shale with vugs partially filled with nahcolite. Lower 4 ft (1.2 m) is pale-yellowish-brown clay containing a few	
2-inch (5 cm) fragments of oil shale-----	1,039.2-1,048.2 (316.7+-319.5)
No recovery-----	1,048.2-1,052.6 (319.5-320.8)
Oil shale, light- to dusky-yellowish-brown inter- laminated with light-yellowish-brown siltstone--	1,052.6-1,063.0 (320.8-324.0)
Oil shale, pale- to dusky-yellowish-brown with minor thin beds of pale-yellowish-brown tuff(?).	
Leaching evident at 1,072 and 1,083 ft (326.7 and 330.1 m), nahcolite in vugs at 1,083 ft (330.1 m). Core discs easily-----	1,063.0-1,083.5 (324.0-330.3)
No recovery-----	1,083.5-1,087.0 (330.3-331.3)
Like unit at 1,063.0-1,083.5 ft (324.0-330.3 m).	
Tuff(?) layers occur between 1,088.6 and 1,089.6 ft (331.8 and 332.1 m)-----	1,087.0-1,093.0 (331.3-333.1)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, pale- to dusky-yellowish-brown, thinly to very thinly laminated. Calcite on fracture surfaces, sparse vugs up to 2 inches (5 cm) in diameter contain minor amounts of nahcolite-----	1,093.0-1,109.0 (333.1-338.0)
Oil shale, as above, interbedded with pale- to moderate-yellowish-brown siltstone beds at 1,109-1,110, 1,112, 1,117, 1,120-1,121, and 1,125 ft (338.0-338.3, 338.9, 340.5, 341.4-341.7, and 342.9 m)-----	1,109.0-1,125.0 (338.0-342.9)
Oil shale, like unit at 1,093.0-1,109.0 ft (333.1-338.0 m), with a very thin tuff(?) bed at 1,149 ft (350.2 m). Collapse breccia zone at 1,142.0-1,142.6 ft (348.1-348.3 m) may match zone at 1,174-1,176.5 ft (357.8-358.6 m) in drill hole USBM-02A. Core loss interval below may match collapse breccia zone at 1,187 ft (361.8 m) in 02A-----	1,125.0-1,152.2 (342.9-351.2)
No recovery-----	1,152.2-1,155.2 (351.2-352.1)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, pale-yellowish-brown, interlaminated, with minor very thin laminae of dark- and dusky- yellowish-brown to olive-black oil shale. A few scattered vugs up to .75 inch (2 cm), some containing minor amounts of nahcolite-----	1,155.2-1,167.0 (352.1-355.7)
Oil shale, as above, interlaminated with thin bedded moderate yellowish-brown siltstone. Possible thin tuff bed at 1,167 ft (355.7 m)-----	1,167.0-1,172.5 (355.7-357.4)
Oil shale like unit at 1,155.2-1,167.0 ft (352.1-355.7 m). Collapse breccias at 1,172.5-1,174.5 ft (355.7-358.0) and 1,175.4-1,178.0 ft (358.3-359.1 m). A thin medium light gray pyritiferous siltstone at 1,174.5 ft (358.0 m). Zone at 1,172.5-1,174.5 ft (357.4-358.0 m) contains a layer of white crystal- line mineral. Unit may correspond to core loss interval 1,201.8-1,209.5 ft (366.3-368.7) in drill hole USBM-02A-----	1,172.5-1,178.0 (357.4-359.1)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
<p>Oil shale, dark-yellowish-brown, very thinly laminated. Thin moderate-yellowish-brown siltstone layer at 1,181 ft (360.0 m), moderately well cemented. Dusky-yellowish-brown to dusky-brown oil shale at 1,185-1,189 ft (361.2-362.4 m). Open vugs, up to 2 inches (5 cm) in diameter, containing minor amounts of nahcolite. Evidence of leaching at 1,197.4-1,198.0 ft (365.0-365.2 m). Minor amounts of calcite and pyrite on fracture surfaces. Unit is brittle and incompetent-----</p>	<p>1,178.0-1,203.9 (359.1-366.9)</p>
No recovery-----	<p>1,203.9-1,207.2 (366.9-368.0)</p>
<p>Siltstone, pale-yellowish-brown and yellowish-gray, very thinly laminated, minor amounts are thin bedded; minor amounts of dark to dusky yellowish brown very finely laminated oil shale and marlstone(?). Faults at 1,218 and 1,230 ft (371.2 and 374.9 m); the lower one has abundant calcite dispersed throughout zone-----</p>	<p>1,207.2-1,230.0 (368.0-374.9)</p>

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Marlstone, pale-yellowish-brown, yellowish-gray, and dark-yellowish-brown; very thinly laminated to thin bedded. Minor amounts of dusky-yellowish-brown oil shale laminae. Thin siltstone stringers. Vugs, 1/4-inch (1 cm), filled with calcite and minor amounts of nahcolite, calcite and pyrite on fracture surfaces. Base of R-6 zone at 1,240 ft (378.0 m)-----	1,230.0-1,287.7 (374.9-392.5)
No recovery-----	1,287.7-1,292.7 (392.5-394.0)
Siltstone, pale-yellowish-brown, yellowish-gray, and medium-gray, thinly bedded; minor amounts of marlstone and oil shale. Vugs (up to 3") contain calcite and nahcolite, pyrite and calcite on fracture surfaces. Collapse breccia or fault zone at 1,318-1,320.8 ft (401.7-402.6 m)-----	1,292.7-1,320.8 (394.0-402.6)
No recovery. Base of L-5 zone at 1,324 ft (403.6 m)--	1,320.8-1,330.3 (402.6-405.5)
Oil shale, dusky-yellowish-brown and dusky brown; very thinly laminated; minor amounts of siltstone and marlstone; evidence of leaching at 1,330.3-1,331.3 ft (405.5-405.8 m); small blebs of nahcolite 1,330.3-1,332.7 ft (405.5-406.2 m)-----	1,330.3-1,335.1 (405.5-406.9)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
No recovery-----	1,335.1-1,335.9 (406.9-407.2) -
Oil shale, pale-yellowish-brown and yellowish-gray, very thinly laminated, platey; interlaminated with nahcolite and halite-----	1,335.9-1,353.4 (407.2-412.5)
No recovery-----	1,353.4-1,363.8 (412.5-415.7)
Oil shale, nahcolite, and halite like unit at 1,335.9-1,353.4 ft (407.2-412.5 m)-----	1,363.8-1,370.5 (415.7-417.7)
Oil shale, brownish-black and dusky-yellowish-brown; very thinly laminated; rosettes of nahcolite-----	1,370.5-1,371.4 (417.7-418.0)
Oil shale, pale-yellowish-brown and yellowish-gray, very thinly laminated; interlaminated with pale brown nahcolite and minor amounts of halite, crystalline zone 1,373.1-1,379.1 ft (418.5-420.3 m). Pitting along laminae in this zone; calcite on some fracture surfaces-----	1,371.4-1,385.5 (418.0-422.3)
Oil shale, dusky-yellow-brown and brownish-black, very thinly laminated, light brown transparent nahcolite rosettes scattered throughout rock-----	1,385.5-1,393.8 (422.3-424.8)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, moderate-brown, dark-yellowish-brown and dusky-brown, very thinly laminated; minor laminae of marlstone. Light-brown nahcolite rosettes to 6 inches in diameter and minor halite beds-----	1,393.8-1,421.2 (424.8-433.2)
Oil shale, moderate-brown, moderate-yellowish-brown and dark-yellowish-brown, very thinly laminated. Intervals between 1,416.5-1,421.5, 1,430-1,448, 1,451-1,477, 1,484-1,486 and 1,487.5-1,489 ft (431.7-441.4, 435.9-441.4, 442.3-450.2, 452.8-452.9, and 453.4-453.8 m) contain nahcolite rosettes up to 6 inches (15 cm) in diameter-----	1,421.2-1,489.0 (433.2-453.8)
Halite, white, translucent-----	1,489.0-1,492.0 (453.8-454.8)
Oil shale, dark- and dusky-yellowish-brown, with minor amounts of yellowish gray and dusky brown, very thinly laminated. Moderate brown translucent crystalline nahcolite in beds, rosettes and pods scattered through unit-----	1,492.0-1,510.8 (454.8-460.5)
Nahcolite, moderate brown translucent and pale-yellowish-brown opaque-----	1,510.8-1,515.0 (460.5-461.8)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale like unit at 1,492.0-1,510.8 ft	
(454.8-460.5 m) amounts of olive-black oil shale---	1,515.0-1,524.0 (461.8-464.5)
Nahcolite, like unit at 1,510.8-1,515.0 ft	
(460.5-461.8 m)-----	1,524.0-1,534.0 (464.5-467.6)
Oil shale, dusky- to dark-yellowish-brown, very thinly laminated. Pods and irregular lenses of moderate	
brown translucent crystalline nahcolite-----	1,534.0-1,549.0 (467.6-472.1)
Nahcolite, pale-yellowish-brown, opaque, crystalline---	1,549.0-1,554.0 (472.1-473.7)
Oil shale, dusky-yellowish-brown, dusky brown, brownish-black, and minor dark-yellowish-brown, very thinly laminated, contains a .8-ft-thick	
(24 cm) nahcolite bed at 1,575.0 ft (480.1 m)-----	1,554.0-1,587.0 (473.7-483.7)
Nahcolite, white- to pale-yellowish-brown bedded, opaque, crystalline interbedded with laminae of oil shale-----	1,587.0-1,598.3 (483.7-487.2)
Oil shale, like unit at 1,554-1,587 ft (473.7-483.7 m)--	1,598.3-1,599.3 (487.2-487.5)
No recovery-----	1,599.3-1,600.8 (487.5-487.9)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, like unit at 1,554-1,587 ft (473.7-483.7 m)--	1,600.8-1,603.8 (487.9-488.8)
Halite, bedded-----	1,603.8-1,604.3 (488.8-489.0)
Interbedded nahcolite and oil shale-----	1,604.3-1,610.0 (489.0-490.1)
Oil shale, like unit at 1,554-1,587 ft (473.7-483.7 m)--	1,610.0-1,616.0 (490.1-492.6)
Interbedded nahcolite and oil shale-----	1,616.0-1,620.5 (492.6-493.9)
Oil shale, like unit at 1,554-1,587 ft (473.7-483.7 m)--	1,620.5-1,622.6 (493.9-494.6)
Interbedded nahcolite and oil shale-----	1,622.6-1,629.0 (494.6-496.5)
Halite, bedded-----	1,629.0-1,629.5 (496.5-496.7)
Interbedded nahcolite and oil shale-----	1,629.5-1,632.0 (496.7-497.4)
No recovery (loss due to solubility of salts)-----	1,632.0-1,639.0 (497.4-499.6)
Oil shale, dusky-yellowish-brown, dark-yellowish-brown, and minor amounts of light brown, very thinly laminated. Interbedded with halite zones up to .5 ft (15 cm) thick, and moderate brown, crystalline, translucent nahcolite beds and "rosettes" some nahcolite is pale-yellowish-brown-----	1,639.0-1,660.0 (499.6-506.0)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, as above-----	1,660.0-1,667.7 (506.0-508.3)
No recovery-----	1,667.7-1,669.0 (508.3-508.7)
Oil shale, like unit at 1,639.0-1,660.0 ft (499.6-506.0 m) scattered nahcolite "rosettes."	
Base of R-5 zone at 1,680.9 ft (512.3 m)-----	1,669.0-1,680.9 (508.7-512.3)
Nahcolite, dusky- to dark-yellowish-brown, contains a halite stringer at 1,682 ft (512.7 m)-----	1,680.9-1,686.9 (512.3-514.2)
No recovery-----	1,686.9-1,699.0 (514.2-517.9)
Nahcolite, like unit at 1,680.9-1,686.9 ft (512.3-514.2 m)-----	1,699.0-1,702.5 (517.9-518.9)
Oil shale, dusky-yellowish-brown with minor amounts of pale yellowish brown, very thinly laminated. Moderate brown translucent, crystalline nahcolite "rosettes" up to 3 inches (8 cm) in diameter scattered throughout core-----	1,702.5-1,715.0 (518.9-522.7)
Nahcolite, pale-yellowish-brown, opaque, crystalline, thin bedded-----	1,715.0-1,717.0 (522.7-523.3)
Oil shale, like unit at 1,702.5-1,715.0 ft (518.9-522.7 m), contains some brownish-black oil shale-----	1,717.0-1,727.9 (523.3-526.7)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, dark-yellowish-brown and dusky-yellowish- brown, very thinly laminated-----	1,768.5-1,777.5 (539.0-541.8)
Nahcolite, like unit at 1,759.0-1,768.5 ft (536.1-539.0 m)-----	1,777.5-1,779.5 (541.8-542.4)
Oil shale, like unit at 1,768.5-1,777.5 ft (539.0-541.8 m)-----	1,779.5-1,783.0 (542.4-543.5)
Nahcolite, like unit at 1,759.0-1,768.5 ft (536.1-539.0 m)-----	1,783.0-1,788.2 (543.5-545.0)
No recovery-----	1,788.2-1,789.0 (545.0-545.3)
Oil shale, like unit at 1,768.5-1,777.5 ft (539.0-541.8 m) with beds and "rosettes" (up to 4 inches diameter, 10 cm) of nahcolite scattered throughout interval-----	1,789.0-1,818.9 (545.3-554.4)
No recovery-----	1,818.9-1,819.4 (554.4-554.6)
Oil shale, dusky-yellowish-brown, contains "rosettes" of nahcolite up to 9 inches (23 cm) in diameter---	1,819.4-1,828.4 (554.6-557.3)
Nahcolite, bedded and "rosettes"-----	1,828.4-1,830.0 (557.3-557.3)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
No recovery-----	1,727.9-1,729.0 (526.7-527.0)
Oil shale, like unit at 1,717.0-1,727.9 ft	
(523.3-526.7)-----	1,729.0-1,734.5 (527.0-528.7)
Nahcolite, moderate-brown, translucent, crystalline, thin bedded, with minor amounts of oil shale-----	1,734.5-1,737.0 (528.7-529.4)
Oil shale, like unit at 1,717.0-1,727.9 ft	
(523.3-526.7 m)-----	1,737.0-1,739.0 (529.4-530.0)
Nahcolite, like unit at 1,734.5-1,737.0 ft	
(528.7-529.4 m). Base of L-4 zone at 1,742 ft	
(531.0 m)-----	1,739.0-1,742.0 (530.0-531.0)
Oil shale, like unit at 1,717.0-1,727.9 ft	
(523.3-526.7 m), contains a 4-inch-thick (10 cm)	
bed of nahcolite and halite at 1,750.9 ft	
(533.7 m)-----	1,742.0-1,759.0 (531.0-536.1)
Nahcolite, pale-yellowish-brown and moderate brown, opaque to translucent, thin bedded with minor oil shale-----	1,759.0-1,768.5 (536.1-539.0)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Interbedded and laminated oil shale, nahcolite and minor marlstone, pale yellowish brown to dusky yellowish brown. "Rosettes" up to 10 inches (25 cm) in diameter. Halite fills vertical fractures at 1,834 and 1,846 ft (559.0 and 562.7 m)-----	1,830.0-1,850.0 (557.3-557.8)
Oil shale, dusky-yellowish-brown, laminated with dusky- to dark-yellowish-brown marlstone. Nahcolite "rosettes" up to 6 inches in diameter every foot or two. Fine- to medium-grained nahcolite bed at 1,873-1,873.5 ft (570.9-571.0 m) and a .1-foot-thick (3 cm) bed at 1,853.8 ft (565.0 m)-----	1,850.0-1,874.0 (557.8-563.9)
No recovery-----	1,874.0-1,879.0 (563.9-572.7)
Nahcolite, interbedded with dark-yellowish-brown and minor dusky-yellowish-brown marlstone(?). Nahcolite beds range from .3 to 1.0 ft (8 to 30 cm) thick. Dark-gray siltstone layer at 1,887.5-1,887.7 ft (575.3-575.4 m). Nahcolite "rosettes" scattered throughout lower half of unit (1,893-1,907.4 ft, 577.0-581.4 m)-----	1,879.0-1,907.4 (572.7-581.4)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
<p>Oil shale, dark-yellowish-brown with minor laminae of dusky yellowish brown, thinly laminated. Bedded opaque nahcolite at 1,908.2-1,908.4 and 1,921.3-1,921.5 ft (581.6-581.7 and 585.6-585.7 m).</p> <p>Nahcolite "rosettes" up to 7 inches (18 cm) in diameter, most are 3-5 inches (8-15 cm). Eroded "rosettes" cause core to be in .5-2 ft (15-60 cm) lengths-----</p>	1,907.4-1,937.2 (581.4-590.5)
No recovery-----	1,937.2-1,937.4 (590.5-590.5+)
<p>Oil shale, dark- to dusky-yellowish-brown, thinly laminated. Thin interbeds of nahcolite at 1,943, 1,960, 1,961.5, 1,969.8-1,970.2, and 1,972.3-1,972.9 ft (592.2, 597.4, 597.8, 600.4-600.5, and 601.2-601.3 m). Nahcolite "rosettes" between 1,946-1,967 ft (593.1-599.5 m) and scattered between 1,968-1,997 ft (599.8-608.7 m). Abundant dolomite lenses up to 1 inch (3 cm) long and 1/8 inch (.3 cm) high throughout oil shale.</p> <p>"60 bed" 1,988-1,992 ft (605.9-607.2 m). Base of R-4 zone at 1,997 ft (608.7 m)-----</p>	1,937.4-1,997.0 (590.5+-608.7)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
<p>Marlstone(?), dark-yellowish-brown, laminated with minor amounts of dusky yellowish brown. Unit contains thin bedded nahcolite at 2,002.0, 2,004.6, 2,017.6, and 2,020.6 ft (610.2, 611.0, 615.0, and 615.9 m). Nahcolite "rosettes" 1-3 inches (3-8 cm) diameter below 2,015 ft (614.2 m). Bottom of L-3 zone at 2,026 ft (617.5 m)-----</p>	<p>1,997.0-2,025.9 (608.7-617.5)</p>
No recovery-----	<p>2,025.9-2,027.1 (617.5-617.9)</p>
<p>Oil shale, dark-yellowish-brown, interlaminated and interbedded with bedded nahcolite ranging from laminae to 3 inches (8 cm) thick. Unit contains pale-yellowish-brown lenses of dolomite up to 2 inches (5 cm) long (most are 1/4-1 inch; 1-3 cm). Rock half or more nahcolite. "Rosettes" of nahcolite up to 1 1/2 ft (45 cm) in diameter-----</p>	<p>2,027.1-2,085.7 (617.9-635.7)</p>
No recovery-----	<p>2,085.7-2,087.0 (635.7-636.1)</p>
<p>Oil shale, like unit at 2,027.1-2,085.7 ft (617.9-635.7 m), with nahcolite beds up to 6 inches (15 cm) thick-----</p>	<p>2,087.0-2,094.0 (636.1-638.3)</p>

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, dark- to dusky-yellowish-brown, containing nahcolite "rosettes"-----	2,094.0-2,116.3 (638.3-645.0)
No recovery-----	2,116.3-2,117.0 (645.0-645.3)
Nahcolite, dark-yellowish-brown, bedded-----	2,117.0-2,123.0 (645.3-647.1)
Oil shale, dusky- to dark-yellowish-brown; unit contains opaque and translucent brown nahcolite "rosettes" up to 1 ft (30 cm) in diameter (most are 3-5 inches, 8-15 cm). Pale-yellow-brown lenses of dolomite below 2,137 ft (651.4 m)-----	2,123.0-2,146.5 (647.1-654.3)
No recovery-----	2,146.5-2,147.5 (654.3-654.6)
Oil shale, dusky-yellowish-brown interlaminated with minor dark-yellowish-brown marlstone. Upper 3 ft (90 cm) is interbedded marlstone, nahcolite, and nahcolite "rosettes." Base of R-3 zone-----	2,147.5-2,163.0 (654.6-659.3)
Marlstone(?) dark-yellowish-brown, thinly laminated----	2,163.0-2,175.5 (659.3-663.1)
No recovery-----	2,175.5-2,177.5 (663.1-663.7)
Marlstone(?), like unit at 2,163-2,175.5 ft (659.3-663.1 m)-----	2,177.5-2,180.5 (663.7-664.6)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, dusky- and dark-yellowish-brown, thinly laminated-----	2,180.5-2,189.0 (664.6-667.2)
Nahcolite, bedded-----	2,189.0-2,195.0 (667.2-669.0)
Oil shale, dark- to dusky-yellowish-brown laminated; minor amounts of marlstone(?) and bedded nahcolite. Nahcolite rosettes as large as 8 inches (20 cm) (most are 2-4 inches, 5-8 cm) scattered through- out core. Dolomite lenses in upper 32 ft (9.8 cm)--	2,195.0-2,245.0 (669.0-684.3)
Marlstone(?), dark-yellowish-brown, laminated, minor amounts of nahcolite-----	2,245.0-2,254.3 (684.3-687.1)
No recovery-----	2,254.3-2,258.0 (687.1-688.2)
Oil shale, dusky- to dark-yellowish-brown, laminated----	2,258.0-2,268.0 (688.2-691.3)
Oil shale(?), dark-yellowish-brown, laminated; contains dolomite lenses 1/8-1/2 inch (.3-1 cm) long-----	2,268.0-2,281.0 (691.3-695.2)
No recovery. Blue marker at 2,284 ft (696.2 m); also base of R-2 zone-----	2,281.0-2,286.0 (695.2-696.8)
Oil shale, dusky- to dark-yellowish-brown, laminated; dolomite lenses-----	2,286.0-2,290.5 (696.8-698.1)

Lithologic description of core from drill hole USBM-01--Continued

Description	Interval thickness ft (m)
Core--Continued	
Oil shale, dusky-yellow-brown, laminated. Unit has what appear to be slickensides on horizontal fracture surfaces, probably the typical-appearing	
Garden Gulch member-----	2,290.5-2,299.0 (698.1-700.7)
Interbedded shale, marlstone and a white bedded material. Shale is bluish-gray from 2,305 to 2,310 ft (702.6 to 704.1 m), marlstone is dusky-yellowish-brown, laminated to thin bedded; white material between 2,299 and 2,305 ft (700.7 and 702.6 m) in layers less than .1 ft (3 cm) thick. Core discs easily. Base of L-1 zone-----	2,299.0-2,310.0 (700.7-704.1)
Interlaminated and interbedded, marlstone, oil shale and shale, dark- to dusky-yellowish-brown. Fossils in 2,326-2,327-ft (709.0-709.3 m) interval, may be fish vertabrae. Whitish, very thin beds between 2,344.5-2,346.0 ft (714.6-715.1 m). Core discs easily. Core shattered in many places-----	2,310.0-2,382.0 (704.1-726.0)
No recovery-----	2,382.0-2,382.5 TD (726.0-726.2)